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Market Structure and Profitability in a Transition Economy

Ukrainian Case

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How does market power influence profitability? Prior research gives no exact answer. However, theory indicates that the relationship is positive. The aim of this paper is to identify whether and how competition influences profitability in the Ukrainian transition economy. Current study employs linear specifications relating profitability to variables that embody competition factors and industries' specificities. Econometric tests provide evidence that concentration indices have no significant effect on profitability at the nationwide level. Nevertheless, competition possibly matters at the level of regional markets. International trade as a source of competition can be a good disciplinary tool for local producers. The vague nature of the relationship between profitability and concentration may signify that competition is flawed in Ukraine.

Keywords. Ukraine, transition, market structure, concentration, structure conduct performance.

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NON-TECHNICAL SUMMARY

The objective of the research was to define whether competition has any noticeable effect on profitability of enterprises in Ukraine, country that experiences a difficult period of transition.

In Ukraine, after several years of transformation earlier centrally planned industries shaped into more or less competitive configurations; *markets* started to acquire *structures*. How does market structure affect actors at a market? Does monopolization lead to higher profitability? What is the role of the foreign competition? A number of theories have been elaborated in order to define the relationship between performance and markets structure. Many were supported by studies of developed economies as well as partially supported with evidences from economies in transition. This research approaches the problem of "profitability — market structure" interrelation in Ukraine.

Generally, theory positively relates profitability and market power; specifically, the higher is monopolization, the higher profitability that firms enjoy. This statement was first empirically tested by J. Bain (1951) who used the so-called Structure-Conduct-Performance approach. Current research, defined in this tradition, uses linear econometric specification relating profitability to variables that embody competition factors and industries' specificities.

In order to differentiate between national and local competition two samples are used: nationwide with variables calculated at the national level and regional with variables computed at the level of region-industries. Besides, in order to define whether the relationship between concentration and profitability varies with different levels of geographic concentration and whether local markets could be a source of market power, a number of concentration indices as well as concentration indices' interactions are tested within the model.

Further, it is maintained that concentration may be endogenous to profitability. To handle such limitation, this study used instrumental variable approach employing pre-reform concentration (exogenous to today's profitability) in instruments' estimation.

Data consists of reported firms' financial indices from the Ukrainian industrial registry (11,045 enterprises in 1998 and 8,134 in 1994) and of statistics on international trade.

Econometric analysis yielded following results: At the national level, concentration indices did not show any noteworthy effect on profitability.

However, at the regional level monopolistic power may increase profitability. Finally, research suggested that international trade could be a good disciplinary tool.

Results of this study partially refuted notion that monopolistic power leads to higher profits. At least in Ukraine, being a nationwide monopolist does not automatically imply evident excess profitability. There are some possible explanations of this contradiction. First, the year of interest — 1998 — was characterized by macroeconomic difficulties caused by the international financial crises. Second, data itself may be inaccurate and/or biased. However, I would also suggest another explanation.

In Ukraine, it is very hard to identify the actual configuration of markets. Structures of industries are heavily distorted due to extensive practices of vertical and horizontal integration. Started with privatization, an incessant chain of mergers and acquisitions created a situation when one firm may dominate several markets; whole industries could in fact be owned by a single business group. Markets' over-regulation, widespread crony relationships between business and government, lack of efficient bankruptcy legislation render usual and commonly accepted market structure indicators futile. Likewise, market forces may fail to function under the burden of non-market regulations and institutions.

1. INTRODUCTION

After the breakdown of the Soviet Union, former Soviet Union economies, including Ukrainian one, were non-optimal designed as a direct plan system. Reforms, on the other hand, affected economic systems, and today one can observe quasi-market structures, which are liable to market forces. Some markets began their movement in the direction of competition; others started to develop towards monopoly. More competition might mean an increase in productive and allocative efficiency, whereas an inherited or acquired monopolistic power would lead to distorted pricing and collection of excess profits.

While theory and many empirical studies positively relate profitability and market power, there is some doubt as to what is the actual nature of profitability-market structure interrelation. These doubts could be further widened: even if the interrelation is assumed positive, does this rule work under conditions of transition? More generally: are market forces strong enough to affect an over-regulated economy? The present paper tries to shed light on this question using Ukrainian economy as an object. Revealing the relationship between market structure and performance would be helpful: considerable profitability of highly concentrated markets would indicate the use of market power and signify the necessity of government interventions in order to improve competition.

The most applicable method of structure-performance analysis in Ukraine is the so-called Structure-Conduct-Performance approach originally employed by J. Bain (1951). This research, defined in the Bain tradition, studies the influence of various market structure determinants on the profitability of enterprises. The basic hypothesis argues that higher market concentration of a market improves profitability.

This paper contributes to the existent literature in several ways. First, it tests the idea that structure affects profitability using the new data of an emerging economy, Ukraine. Second, unlike previous studies of Ukraine, which use small samples of firms, this research employs the comprehensive database of manufacturing enterprises consisting of 11045 firm-entries classified in 289 industries for the year 1998. Third, in contrast to available researches, which investigate the problem of structure-profitability interrelation marginally, together with a range of other issues, the present study focuses solely on structure-profitability interrelation in Ukraine. Finally, there are many studies of market structure & profitability based on Russian economy. Ukraine resembles Russia in economic sense, having nevertheless significant differences (geography, speciali-

zation, and infrastructure). This research gives a chance to compare characteristics of these two economies, which were a single whole in the past, as well as to compare new findings with the studies of other emerging economies.

The results of present study can be summarized as follows: concentration has no significant effect on profitability at the nationwide level. Estimated parameters of various concentration indices are negative and insignificant at the nationwide level and positive but also insignificant at the level of local industries. Thus, competition possibly matters only at the level of regional markets. International trade is a good source of competition. Negative significant estimates of the import penetration ratios suggest that import acts as a disciplinary mechanism.

This paper is organized as follows. The next section summarizes relevant prior research experience and outlines the conceptual framework of the study. Section 3 describes data and econometric approaches and discusses results. Section 4 presents several concluding remarks.

2. REVIEW OF LITERATURE/CONCEPTUAL FRAMEWORK

For many years industrial economists have been studying the relationship between performance and concentration indices. Cowling and Waterson (1976) proved the direct interdependence between Herfindahl–Hirschman concentration index (*HHI*) and price-cost margin (*PCM*):

$$\sum_i s_i \frac{p-m}{p} = -\frac{\sum s_i^2}{\varepsilon} \equiv -\frac{HHI}{\varepsilon}.$$

That is, the *HHI* divided by the absolute value of the market demand elasticity equals the weighted average of the firms' price-cost margin.

The theory was tested many times and, in many cases, this relationship holds. However, due to the imperfect measures of price-cost margins and due to other influences in the general model, several other aspects of industry structure are often included. Comanor and Wilson (1967) argue that advertising substantially influences concentration. Guth (1971), Strickland and Weiss (1976), Lee (1986), Gabel (1979) used advertising variables to explain the monopolization level and profitability. Caves (1980), Chou (1986), and Helpman (1997) revealed the influence of FDI & on concentration indices and performance. Jacquemin, Ghellinck, and Huveneers (1980), Chou (1986), Barton and Caves (1990) examined the effect of international trade on competitive environment and production performance.

Many researchers, particularly in recent years, studied productive efficiency focusing on the estimation of production function and analyzing the influence of different factors on TFP. Through 70s and 80s, considerable number of studies continued using Bain's (1951, 1956) practice testing the interrelationship between industry-average profitability and concentration. They found only weak evidence of positive interrelation between profitability and concentration. Whereas such results could be associated with poor data and/or measuring drawbacks, the problem of concentration-performance interrelation in Demsetz's (1973) interpretation is also worth attention: in modern economies, concentration indeed may directly depend on market forces; firms that are more efficient can conquer markets. Nevertheless, in post-socialist economies the dependence of concentration on market forces is negligible. Concentration is more likely to be defined exogenously by the centrally planned economy. Brown and Earl (2000) also support this point of view.

Besides, there are several other approaches. Sutton's theory is among them. Sutton generated robust and testable predictions from the theory of strategic behavior. The basic theoretical notion is that in homogenous *type 1* industries, characterized by exogenous sunk cost, the traditional inverse structure-size relation holds. However, in *type 2* industries, characterized by endogenous sunk costs, as market size becomes very large, firms may escalate their advertising and/or R&D expenditure in response, and the inverse structure-size relation may break down. Sutton's own empirical work confirms his predictions combining cross-section analysis with industry case studies.

In Ukraine, market structures are starting to change. Advertising market has grown substantially. This indicates that industries could be discriminated now by the level of product differentiation. Some markets are becoming *type 1*, others — *type 2*. Still, the precise analysis of available data for transition economies reveals that today it is still difficult to study concentration in view of Sutton theory.

In recent years, with the appearance of *de novo* market economies, the new subject of the analysis emerged — economies in transition. Since the present research considers the Ukrainian transition economy, mentioned literature segment is of the particular importance. Several issues are in the focus here. Productive efficiency and factors that affect it (ownership structure, competition, trade, FDI, soft budget constraints, infrastructure and institutions) is the most frequent theme. Earle and Estrin (1998), Brown and Brown (1998, 1999), Brown and Earle (2000) studied Russian economy. Konings (1997), Angelucci, Estrin, Konings, and Zolkieski (2001), Konings, Van Cayseele, and Warzynski (2001), Klinedinst and Rock (1998) devoted their research to comparative studies of Bul-

garia, Romania, Poland and Hungary; Konings and Xavier (2002) studied the determinants of firms' survival and growth in Slovenia. Carlin, Fries, Schaffer, and Seabright (2001) made a cross-country survey focusing on the competition and enterprise performance in transition economies. Many studies verified the concept that competition, whether domestic or foreign, improves productive efficiency. However, the idea of an increase in price-cost margins with higher monopolization received only a partial proof. In Brown and Brown (1998), there is the weak evidence that in Russia higher concentration leads to higher profits at the nationwide level, although at local markets monopolistic power is an advantage embodied in higher profitability. In Konings, Van Cayseele, and Warzynski (2001), in Bulgaria the higher concentration leads to higher profits, but this is not proven for Romania.

Attempting to verify the idea that higher price-cost margins are associated with monopolized markets, this study will principally follow Brown and Brown (1998) using the linear specification relating profitability to the variables that embody competition factors and industries' specificities (controls):

Profitability = *f* (Competition Factors, Controls).

3. MODEL SPECIFICATION AND ESTIMATION RESULTS

3.1. Specification

Profitability. Rate of return, the measure of how much is earned per dollar of investment, was once considered as the most appropriate gauge of performance. Other financial ratios of performance are *ROA* (the net profit after taxes per dollar of assets) and *ROE* (the net profits after taxes per dollar of equity capital).

However, many studies have shown that accounting measures like the rate of return may fail to measure economic profits or costs accurately, especially when long-lived capital assets are present. In transition economies, accounting profit is much more dubious measure of performance because of misreporting. To avoid these problems the study uses an alternative measure of performance, the *Lerner index* or price-cost margin, $(P-MC)/P$, that shows difference between price, P, and marginal cost, MC, as a fraction of price.

Alas, because the genuine price-cost margin is rarely available, researchers use "price-average variable cost" margin instead of appropriate "price — marginal cost" margin. This approximation to the price av-

erage cost variable is calculated as sales revenues minus payroll minus material cost divided by sales.

With available data on Ukrainian enterprises, it is possible to estimate a number of profitability ratios. The first is *PCM* estimated as sales less total production cost divided by sales. This is the most close markup estimation available now. Data also allows estimating the share of profits in sales *PS* as profits before profit tax divided by sales, and the share of profit in total production cost *PO* as profits before profit tax divided by total production cost.

Market Structure. Market concentration is the most regular proxy for market structure. The most common statistical measure of concentration as an index of market structure is the so-called "k-firm concentration ratio" *Ck*, which is the share of industry sales accounted for by *k* largest firms:

$$Ck = \sum_{i=1}^{K} s_i \ ,$$

where s_i is the share of the *i*-th firm.

It is arbitrary to choose the number of firms k. In empirical testing *C*4 is the most common index. Other measures are used as well. For example, the US government has published eight-firm concentration ratios, *C*8. The major drawback of such index is that it implicitly assumes equal weighting to all firms in the sample, and thus it fails to take into account information concerning the size distribution of firms in the industry (Bevan, Estrin, Schaffer, 1999).

To make concentration index more representative one could employ a function of all individual firms' market shares, *HHI*, defined as the sum of the squared values of firms' shares calculated as follows:

$$HHI = \sum_{i=1}^{n} S_i^2 \ ,$$

where S_i — the share of *i*-th firm at the market, *n* — total quantity of firms at the market. The higher is the *HHI* , the bigger the monopolization of the market.

Concentration measures have several serious drawbacks. To be usable in studies, an index of structure should be exogenous, where *exogenous* implies that structure is determined before profitability and that profitability does not affect structure. If the measure of structure is determined by profitability, or endogenously determined, the estimates would be inconsistent. For that purpose, one needs to develop an instrumental

variable. Brown and Brown (1998) use the last year before transition 1991 (in that year concentration was not affected by market forces) in order to filter out the endogenous profitability-caused portion of the change in concentration. In Ukraine, reforms started three years later. Pre-reform (1994) concentration ratios help to develop instruments for concentration in this research. On the contrary, in post-soviet economies, Ukrainian is among them, market structures are hardly affected by market forces because the structure was formed under the Soviet centrally planned system. Soviet planners could have been taking into account cost optimization, but one barely would argue that structure was determined by market efficiency considerations in the SU. Market structure should be changing while the transition processes — privatization and restructuring — result in new ownership redistribution. Still, these developments have little in common with market force influences. Hence, the endogeneity drawback, rather serious while analyzing western economies within *SCP* framework, is not that significant in post-soviet economy's studies. Nevertheless, it is useful to employ instrumental variable (IV) methodology to avoid potential estimation bias.

Another crucial weakness of regular concentration ratios is that they are commonly calculated based on industries — industrial index of concentration. Yet, the official classification of industries fails to reflect the genuine product market nature. For instance, an enterprise producing a wide variety of products has one industry code. The best way would be to calculate indices based on the product market concept. Still, data constraints allow us to employ only the "second-best", commonly used method of *industrial* concentration.

Further, concentration ratios could be estimated as nationwide or regional. Typically, nation-level concentration is under consideration. Yet, some industries, being apparently competitive countrywide, in fact enjoy monopolistic power at the local markets. Therefore, local (in this research — regional) concentration ratio *HHI_R* is employed in the regionally disaggregated sample model (*Region-industry model*).

Let us go on with elaboration of concentration ratios. To start with, two most common concentration ratios *HHI_N* and *C*4 are calculated. The important remark about them is that both are obtained for the national level. *HHI_R* is similar to *HHI_N* apart from it is calculated at the level of region-industry.

Further, let us assume that firms within a region compete only with local companies (enjoy higher monopolistic power) but they face higher competition embodied in the national *HHI_N* outside the region. In other words, if there were an industry with a limited number of producers lo-

cated in one region only, they would operate nationwide. Conversely, if every region has at least one enterprise of some industry, these firms would operate mainly in their own regions. Constructing the appropriate concentration measure that would embody options of local and national competition, this study follows Brown and Earle (2001) and uses the *linear combination* of *HHI_N* and *HHI_R* (described above). The mixed *HHI_M* is calculated as follows:

$$HHI\_M = HHI\_R^{*}\text{Prop} + HHI\_N^{*}(1 - \text{Prop}),$$

where Prop is the proportion of regions with at least one producer in a given industry. This concentration measure is employed in the *Region-industry* model.

To compensate for possible underestimation of national concentration ratios one may introduce into the model the ratio of geographic production dispersion *DISP* calculated as follows:

$$DISP_j = 1 - \frac{\sum_i \left| s_{ij} - SP_i \right|}{2},$$

where s_{ij} is the share of the *j*-th industry's output in the *i*-th region and SP_i is the share of population in the *i*-th region. The intuition behind this index is clear-cut: if the geographic dispersion of the output of an industry tends to be the same as the geographic dispersion of the population in the country ($DISP \to 1$), the market has regional nature (*e.g.* dairy, baking, or confectionery industries), otherwise production could be regionally concentrated and such industry could sell countrywide. A very close idea is exemplified in another index — the index of raw geographic concentration *GC* used by Ellison and Glaeser (1994). The discussion of differences between *DISP* and *GC* is included in the Appendices.

High regional concentration may lead to collusions and mergers. Moreover, the very relationship between concentration and profitability can vary in industries with different levels of geographic concentration (Brown and Brown, 1998). To catch the idea of regional markets competition and to take into account the above stated observations, this study uses concentration interactions multiplying the raw concentration indices *HHI_N* and *C*4 by *DISP*.

Extra variables. Capital-labor ratio *KL* is included to control for the industry specificities and to assess the influence of capital intensity. Industries with high *KL* ratios could be highly concentrated (*e.g.* certain machine-building industries) but unlike in theory, they could be unprofitable due to other factors (demand shocks, inefficient technologies). One

may also consider *KL* as a control for another capital-intensive industries' specificity: in Ukraine, low capital depreciation rate could distort profitability (the measure of profitability in this study embodies capital depreciation). Finally, the purpose of *KL* ratio introduction in level form is to catch the effect of entry barriers.[1]

Export *EX* and import *IM* are considered as factors of international competition. Firms (industries) with high level of exports in fact compete at the international market that could mean higher efficiency and better (world level) performance as well as higher competitive pressure that reduces profits. It is also very important to catch the effect of the international competition at the national market: higher import penetration increases competitive pressure and decreases profitability. In this research *EX* is the total industries' value of exports divided by the total industries' value of sales; *IM* is import penetration ratio calculated as imports divided by sum of imports and domestic total sales. Import in fact may be endogenous to profitability as profitable markets attract international producers. Nevertheless, since predicted effect of *IM* on profitability is negative and the likely effect of profitability on *IM* is positive, the potential bias will not change the sign of the estimate: it may only have an imprecise absolute value.

Finally, industry dummies *D*(*x*) are employed as controls for 2-digit industries' specificities.

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[1] Among entry barrier factors determining structure, economy of scale is recognized as essential. Minimum efficient scale, calculated as weighted average capacity of top enterprises that produce about 50% of the industry output divided by the market size, is used most often. It positively affects profitability: the higher is the scale, the less likely the entry of a competitor. However, there are rational opinions that such *MES* could not be an instrument for scale effect. Real scale effect should be calculated based on the technological data of every enterprise, which is hardly feasible. At the same time, a number of researchers argue that *MES* in the form stated above can be a proxy for concentration (in that way those researchers explain high correlation between concentration indices and *MES*). Alternatively, *MES* calculated properly may be a good proxy for entry barriers that in theory improve performance of incumbent firms.

Advertising-sales ratio is a proxy for entry barriers as well. Consumers recognize products by ad messages being loyal to one selected brand for a long time. This creates sunk cost for new contestants. Thus, the higher are the ad expenditures, the higher the concentration, and the higher the profits. That is why, some researchers include advertising variable in their specifications. Nevertheless, the problem of good exogenous measure for Ads persists. In reality, higher profitability would attract newcomers who are ready to bear sunk cost and advertise. This is very often situation in Ukraine. Such potentially profitable industries as foods and pharmaceuticals attract newcomers who start to familiarize their brands by means of aggressive advertising.

As regards Brown and Brown (1998), where the basic specification was adopted from, besides the exclusion of *MES*, it differs from the present study in several more ways. First, this research includes import penetration ratio recognizing that import serves as a disciplinary tool for domestic firms. Second, instead of the absolute capital requirements and the capital-output ratio this paper uses *KL* ratio (described above). Third, the current study does not aim to verify effect of ownership structure therefore it excludes such variable (unlike Brown and Brown). Finally, the cross section nature of the data does not allow using year-by-year industry growth as a control for profit margins resulting from unanticipated growth.

The summary on computation of all variables is offered in Table 1. in the Appendices.

Econometric model. The basic econometric specification used in the research is as follows:

$$\text{Profitability} =$$

$$= \beta_0 + \beta_1 \text{Concentration} + \beta_2 DISP + \beta_3 IM + \beta_4 EX + \beta_5 KL + \beta_6 \sum D(k) + u.$$

This model is estimated for two different samples: *Nationwide* and regionally disaggregated *Region-industry*. In the *Region-industry* model, all variables are calculated in the same manner as in the *Nationwide* model for regional sub-industries. Only *IM* is calculated as nationwide since it is difficult to track how imported goods are distributed within regions. *HHI_R* and *HHI_M* are used for *Concentration* in the *Region-industry* model. To test different variables, the standard *PCM* as well as *PS* and *PC* for *Profitability* and *HHI_N* and *C*4 for *Concentration* will be employed in regressions. Further, the *Nationwide* model is extended. Concentration interactions *HHI_N*DISP* and *C*4**DISP* enter the model together with original *HHI_N* and *C*4 in order to test the hypothesis that the relationship between concentration and profitability varies with different levels of geographic concentration and that local markets are a source of market power for oligopolistic industries.

I suggest Instrumental Variable (IV) 2*SLS* approach to cope with the endogenous concentration variables. All concentration indices *HHI_N*, *C*4, *HHI_R*, and *HHI_M* as well as interactions *HHI_N*DISP* and *C*4**DISP* are instrumented using all exogenous variables in the model plus additional indices of concentration or interaction for the pre-reform year (1994). These extra pre-reform indices being exogenous to post-reform profitability help to solve the problem of endogenous concentration. *DISP* is not instrumented. In practice geographic dispersion of industries does not change considerably: with few exceptions, new enterprises appear in

the same regions as the old ones, if appear at all. The discrepancy in the *DISP* for the years 1994 and 1998 is mainly due to the disparity in the sample coverage.

3.2. Data

Present study uses several data sources. The key one is the database *Fenix* that consists of financial indices of the majority of Ukrainian manufacturing enterprises for the year 1998 from the Derzhkomstat industrial registry (the Ministry of statistics of Ukraine). Derzhkomstat data on 1994 enterprises' sales is used for the computation of instruments. The Ministry's of Economy Database on imports gives the data for import penetration ratios.

Let us proceed with the analysis of the raw data used for variables' computation. *Sales* (UAH'000) represent all revenues received from the main activity of an enterprise net of VAT and other activities' revenues. *Cost* (UAH'000) is net cost of production including inputs, capital depreciation, excluding VAT, administrative and "sales" expenditures, interest payments, and capital expenditures (investments). *Employment* (persons) is the year-average quantity of employees. *Export* (UAH'000) is the amount of enterprise's sales exported. *Capital* (UAH'000) is the balance-sheet (initial, installation) value of production assets, excluding other (non-productive) assets. *Profit* (UAH'000) is the net profit before profit tax; it is an index that arises when total sales are decreased by VAT, production cost, expenses and revenues obtained from other activities, interest paid, and capital expenses. The raw data on *Import* (USD'000) is represented by a sample of the so-called 4-digit product groups (1166 total). The majority of product groups (set of groups) matches corresponding industry identifiers. If the industries are more disaggregated than import product groups, I used the same amount of import for such industries, *e.g*. two industries, the peat industry and the peat bricks industry, have import penetration ratios based on the same import item as stated: "peat & peat brick". On the other hand, if imported products are in several items, but domestically they are produced by one 5-digit industry, the import penetration ratio is built on the sum of analogous product items. Import, initially represented in thousand USD, was converted in 1998 UAH (1998 year-average exchange rate is 2.66 UAH/USD).

All financial data is firm level. Originally, it was obtained from enterprises' financial reports. The year 1998's database covers 11045 enterprises; the year 1994's sales dataset (used in calculation of pre-reform concentration) consists of 8134 firm-entries. Derzhkomstat data does not in-

clude *de novo* private or joint-ventures firms and consists primarily of the former state manufacturing enterprises, privatized afterwards. Reported employment varies from 1 to 36142 members of staff. Derzhkomstat provides the opportunity to disaggregate industries by the standardized 5-digit industrial codes. After the exclusion of data on energy & heating and water conduits (due to regulations and other non-market features of these industries) the nationwide sample consists of 289 industries for the year 1998 and of 271 for the year 1994. The pre-reform sample of enterprises is smaller. For that reason several other industries drop out in IV estimation[2]. Every firm-entry in addition to the 5-digit industry identifier has the 4-digit region identifier. There are 25 basic regions (oblasts), plus Kiev and Sevastopol as separate territorial entities. Those separate cities' enterprises were joined with the corresponding regions. Such system of codification facilitated the computation of the mixed industrial concentration index and the index of geographic concentration, as well as to design special case of model specification, where variables were calculated for region-industries. At the region-industry level the largest sample is 1924 and 1907 non-missing entries are used in estimation. Two samples are compared in the Table 5 in the Appendices. There is evident difference between samples. Due to higher geographic concentration of metal and chemical industries, their share in national sample is bigger than in the region-industry sample. The opposite can be noticed about light and food industries. The first preliminary comment is that the influence of light and foods industries' peculiarities would be higher in the regional-industry specification.

Brown and Brown (1999) analyzed Russian market structures among others. It is interesting to compare our Ukrainian sample with the one used by above-mentioned authors. The decomposition of the sample by output is represented in the Table 6 in the Appendices. Casual analysis of this table shows that Russian output structure is rather similar to Ukrainian. The substantial difference is in energy, metallurgy, and foods, where Ukraine outweighs Russia, and machine building and light industries, where the pattern is opposite. Another important lesson, or rather pre-estimation prediction, is that such branches as metallurgy, machine building, and food are important due to their dimensions: they could also significantly influence estimation results.

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[2] Aluminum and magnesium rolling, Secondary non-metallic scrap processing, Mining chemical, Asbestos, Agricultural tooling, Limestone flour, Vinyl, CD, tape cassettes, Feed mill, Precious metals extraction and production, Elevators, Auto- and electric loaders, Vacuum pumps, Zirconium and hafnium, Painting equipment industries are among the drop-out entries.

Let us now focus on *C*4 ratios of Ukrainian industries as compared to Russian (Table 7(*a*) and Table 7(*b*) in the Appendices). It is easy to deal with Russian industries, as industrial codes are the same for Ukraine 1998 and Russia 1992. The analysis of data reveals that Russian industries generally have more firms; they are less concentrated than Ukrainian ones. Correlation between two *C*4 indices shows similar patterns. Correlation (*CR*4 Ukraine; *CR4* Russia) = 0.61.

Let us conclude the description of data with a brief analysis of summary statistics (Table 8 and Table 9 in the Appendices). First, mean *PCM* in the region-industry case is negative while in the national case it is positive. Second, concentration ratios differ as well: mean *HHI_R* is significantly higher than mean *HHI_N* and mean *HHI_M*, and comparable to mean *C*4. The pre-reform concentration indices have higher mean values, which could point out higher pre-reform concentration as well as could be a product of smaller sample of pre-reform data. However, those differences are sufficiently small and can be disregarded.

The correlation analysis (Table 10 in the Appendices) reveals that there is no high correlation between variables in the model, except for *DISP* and concentration ratios. Higher geographic concentration (lower value of *DISP*) is associated with higher market concentration.

3.3. Estimation results

Primarily, performance measures were tested. Results of *OLS* disclosed the superiority of *PCM* (Table 11 in the Appendices). For that reason only *PCM* was used in estimation of latter models.

As proposed, this study employs the following strategy of econometric estimation. There are two samples: Nationwide and Region-industry. The former model uses *C*4, *HHI_N*, and interactions *C*4**DISP* and *HHI_N***DISP*. The latter one employs *HHI_R* and *HHI_M*. All estimations are performed using both *OLS* and 2*SLS* IV approaches (Tables 12–14 in the Appendices). The F-test of the joint significance of the instruments in the IV first-stage regressions leaves no doubts about the acceptable choice of instruments. The estimation with robust standard errors (using White-corrected standard errors, not reported here) gives the same signs, which proves the robustness of the estimated parameters. Obtained R^2 suggests that the Nationwide model specification is proved to be more functional, whereas the Region-industry specification showed low explanatory power.

As it is evident from the tables, the effect of concentration on *PCM* is not established. *C*4 and *HHI_N* negatively affects *PCM*, still this effect is

highly insignificant. Only Nationwide *OLS* specification produces significant negative estimate of *HHI_N*. However, the Hausman test suggests that *OLS* is an inconsistent estimator for this framework.[3]

The Region-industry model produces unexpected results as well. Here, *OLS* exhibits negative statistically significant estimate of *HHI_R*. Mixed concentration index does not affect profitability in this specification: the estimates are insignificant. Specifications with interactions show that profitability of nationwide industries is not sensitive to concentration: the estimates are insignificant and negative. At the same time, localized industries benefit from higher local concentration, though this result is not conclusive due to the problem of inadequate level of statistical significance.

Concentration indices testing produced results that contradict general theory and western experience. They also differ in some ways from the results of previous studies of transition economies. Brown and Brown (1998, 1999) reveal the comparable finding; still, the effect of local competition is statistically significant in their study. In Konings, Van Cayseele, and Warzynski (2001), higher concentration leads to higher profits in Bulgaria, but this is not proven concerning Romania (yet their paper produces more persuasive evidence of positive concentration-performance interrelation in Romania than the present one). Although Konings and Xavier (2002) use different specification, concentration in their model does not have any significant effect on the survival of enterprises. It becomes evident that the long history of concentration-profitability interrelation studies does not give the obvious results. Surely, there could be some doubts about the data used for estimations and the nature of the *industrial* concentration indices that differ from the preferred *market* concentration indicators. However there are several credible remarks about the flawed nature of competition in the transition economies. This issue is addressed in the concluding section.

The importance of foreign competition is indicated by statistically significant estimates of *IM* and *EX* variables in virtually all specifications. Only

[3] As this study uses IV approach to avoid the drawback of endogenous concentration variables, the Hausman test was performed with all specifications in order to test whether there is sufficient difference between the coefficients of IV and standard *OLS* to indicate that *OLS* is inconsistent in our specifications. The test was performed with estimated intercepts, since the constant have the same interpretation for both models, and with the variance from the more efficient estimator. The Hausman test indicates that *OLS* is an inconsistent estimator for the Nationwide model. However, it fails to determine the appropriate specification for the Region-industry model.

Region-industry *OLS* specification with regional *HHI_R* index produced insignificant estimate of *IM* (still negative). However, since the model uses nationwide import penetration index in this specification (it is difficult to track how imported goods are distributed within regions), this insignificant estimate may be addressed to that circumstance. The study confirmed findings of previous researches: import can be a good disciplinary tool. Indeed, competitive pressure from imported products impedes local producers' profitability. In that way, having negative, but rather low correlation with *PCM*, *IM* produced highly significant estimates, which confirms the hypothesis about competitive pressure from importers. This pressure, although decreases profits, forces local producers to be more efficient and makes consumers better-off.

On the other hand, export variable produced an unexpected result. Usually, exporters enjoy higher profitability. However, present study reports different outcome. The first explanation of the negative *EX* estimate is that exporters face higher competition from more efficient foreign producers at the international markets. However, in such situation exporters would prefer not to export at all to avoid anticipated losses. Thus, the best explanation of results could be the data and the year of analysis. 1998 was the year of international financial crisis. Ukrainian exporters faced a demand shock and incurred cost outlays were not covered during that year.

KL has no stable sign. *OLS* procedures produce insignificant negative estimates. From this it follows that *KL* could serve as a control for the possible negative bias in profitability of capital-intensive industries. However, IV 2*SLS* estimation being preferred in the current study produces the different result: *KL* has positive and significant effect on *PCM*. Thus, high *KL* ratio can signify entry barriers. Incumbent firms enjoy the situation when the entry of newcomers is prevented with the high sunk cost.

Estimated parameters of industrial dummies (most are insignificant) show no evidence of considerable differences between 2-digit subindustries. The only valuable finding is the negative significant parameters of *D*1 (fuel) in the Nationwide framework and *D*2 (light industries) and *D*7 (metallurgy) in the Region-industry framework. This may indicate the poorer overall performance of mentioned industries.

Finally, let us consider geographic concentration ratio. The estimate of *DISP* is negative (though insignificant). This reveals comparatively high profitability of geographically concentrated industries. The higher is the value of *DISP* (the lower the concentration), the poorer the performance. As this index represents mostly consumer goods industries, this means that the regional production of goods in such industries is rewarding. The

reality verifies theoretical findings. One of the recent trends is the appearance of very competitive food producers in accordance with product groups' climate zones: vegetables in southern regions, confectionary in sugar-producing regions.

4. CONCLUDING REMARKS

The goal of this research was to study the interrelation of profitability and concentration, and to determine where the competitive pressure comes from. A number of concentration indices were computed and employed in various specifications. The research used exogenous pre-reform concentration ratios in the estimation of the instruments for concentration; it helped to avoid the common problem of alike studies — concentration endogenous to price-cost margin.

This work provided evidence that international trade increases competitive pressure and negatively affects profitability.

The study, however, produced a number of unanticipated results: the effect of domestic market concentration is not statistically significant and frequently negative. Generally, competition has the same effect in every economy: it makes firms more efficient. The same story is with monopolization: it increases profitability in any economy (via the abuse of market power), other things being equal. However, very often, market forces distorted or softened in a transition economy do not play their genuine role. Ukraine is a brilliant illustration of how market forces may fail to function. In this country, the real market structure is rarely clear. A concealed industrial group could patronize several seemingly competitive firms or even entire industries, coordinating a big horizontally integrated establishment. Vertically integrated conglomerates are the other distinctive feature of Ukraine. Production chains of these businesses start from metal mining and mineral extraction and finish with exported machinery. Not only the concentration ratios lose their meaning, but also it is hard to discriminate between industries. If one takes into consideration the soft budget constraints and excessive government regulations (in Carlin, Fries, Schaffer, and Seabright (2001), Ukraine is ranked 15-th out of 25 emerging economies in the soft budget constraints rating, and 21-st out of 25 in business environment quality rating), it seems apparent that market forces in Ukraine have enough barriers to fail to function.

Further, one may suspect that some peculiarities of the research subject (Ukraine) would not allow designing a representative measure of concentration. Usually Herfindahl–Hirschman index is preferable to the $C4$ as it considers all enterprises in the industry and takes into account the size

distribution of firms. In such a way, one can explain bad performance of *C*4 in the estimation. At the same time, there is no effective bankruptcy legislation in Ukraine. Consequently, the virtually bankrupt firms go on operating and are present in the sample used in the research. Information about such firms is also embodied in *HHI* index making it unable to reflect the factual state of competition.

Finally, a portion of concern could be addressed to the year of the analysis, 1998. Because of the financial crises in Asia and Russia and its contagion effect within Ukraine, local firms, especially exporting, experienced a demand shock (external and domestic). Considered and planned cost outlays were not covered with sales revenues that year. As it was supposed above, this is indeed the case with the negative estimate of the export parameter.

In conclusion, it is essential to outline a number of further research areas. First, to access the interrelation between concentration and profitability one would like to employ data that are more comprehensive: to use data not only for the one-year period, but also for the several successive periods (panel data set). This approach would eliminate the drawback of possible bias resulting from year specificities. Second, a deeper analysis of concentration evolution would be promising, as indicated by an evident change in concentration indices.

APPENDICES

A1. Discussion of differences between *DISP* and *GC*

As it is mentioned above, this paper uses *DISP* index of geographic concentration. The very close idea is exemplified in the other index — the index of raw geographic concentration *GC* used by Ellison and Glaeser (1994):

$$GC_j = 1 - (\text{norm}) \frac{\sum_i \left(s_{ij} - x_i\right)^2}{1 - \sum_i x_i^2},$$

where s_{ij} is the share of the *j*-th industry's output in the *i*-th region and x_i is the share of the *i*-th region's output in total nationwide output, and "(norm)" means normalized (divided by maximal estimated

$$\frac{\sum_i \left(s_{ij} - x_i\right)^2}{1 - \sum_i x_i^2}).$$

GC index has almost the same nature as *DISP*. The higher is the discrepancy between the share of given industry's production in a region and the share of total output in this region, the higher the geographic concentration of that industry, and the closer to zero the *GC* index would be. Ellison and Glaeser (1994) argue that industries with high raw geographic concentration should have some stimulus to be as concentrated as they are. They discuss two main reasons: the spillover effect and the natural advantage. Indeed, such industries as metallurgy and coal mining should be geographically concentrated since they both enjoy spillover and natural advantage effects. Fishing industry should have higher *GC* than baking since bread is produced everywhere and fishing is possible at the seacoast. Yet, *DISP* and *GC* are different. Whereas *DSIP* embodies the difference between population and production shares in regions, *GC* embodies irregularities in production only. Considering the different nature of the population-output distribution in Ukraine (see Table 2 and Table 3) *DISP* and *GC* should not be highly correlated. I presume, that *DISP* could be applicable for the most part to consumer goods, since it employs population shares in estimation, and *GC* could be applicable to investment or non-consumer goods (the regions where output share bigger than population share typically have heavy industries).

The difference in meaning of *GC* and *DISP* could be otherwise explained by the example. The coal-mining machine building industry is mainly concentrated around the coal mining industry in Donbass region (three eastern oblasts). Consequently, it sells its products in the same region, but not nationwide. Almost all heavy industries are good examples. In such case, a high regional concentration of an industry does not mean the operation all over the country. The opposite is with *DISP*, which is associated with consumer goods. Local production of wines (high geographic concentration) can imply countrywide marketing.

Although *GC* index received the comprehensive portion of the analysis, it is not used in the estimation. First reason is that it does not shed light on the object of the analysis more than *DISP* does, though there are a number of interesting features and differences that are beyond the scope of this study and could be the theme of the further research. The second reason is that *DISP* gives the opportunity to compare new findings with other identical research, including Brown and Brown (1998).

A2. Tables

Table 1. Definition of variables.

Profitability	
PCM	Price-cost margin: sales minus cost divided by sales.
PS	Profit divided by sales.
PC	Profit divided by total cost.
Concentration	
HHI_N	Herfindahl–Hirschman index: sum of the squared values of firms' shares in sales (*HHI*); commonly calculated for the year 1998.
*C*4	Share in sales accounted for by 4 largest firms.
HHI_R	*HHI* calculated at the level of regional industry (part of given industry in one of 25 separate regions).
HHI_M	*HHI_M* = *HHI_R**Prop + *HHI_N**(1 − Prop), where Prop is the proportion of regions with at least one producer in a given industry. *HHI_N* and *HHI_R* are defined as above.
DISP	Measure of dispersion calculated as follows: $DISP_j = 1 - \frac{\sum_i \lvert s_{ij} - SP_i \rvert}{2}$, where s_{ij} is the share of the *j*-th industry output in the *i*-th region and SP_i is the share of population in the *i*-th region.
*HHI_N*DISP*	Interaction of original nationwide *HHI_N* and dispersion *DISP*.
*C4*DISP*	Interaction of *C*4 and dispersion *DISP*.
I*HHI_N*, etc.	The index I (for instrument) before the concentration variable means that this concentration ratio, whether original *HHI_N*, weighted *HHI_W*, mixed *HHI_M*, or *C*4 is calculated as described above for the pre-reform year 1994 and used for instrumental variable estimation.
Extra	
KL	Capital divided by Employment.
EX	Export divided by Sales.
IM	Import penetration ratio. Import divided by (Total domestic enterprises' Sales plus Import).
D(x)	Industry dummies *D*1, ..., *D*8 for branches (no dummy for "other industries" sub-branch).

Table 2. Differences in shares (%) of population and output by region.

Regions	Population share	Output share	Difference
Donetsk	17.4	19.1	−1.7
Dnipropetrovsk	11.1	17.6	−6.5
Lugansk	8.3	6.8	1.5
Kiev	7.1	8.3	−1.2
Kharkiv	6.4	6.6	−0.2
Zaporizhya	5.5	8.2	−2.7
Lviv	5.2	2.9	2.2
Poltava	3.2	6.1	−3.0
Sumy	3.1	0.4	2.7
Vinnitsia	2.8	2.0	0.8
Zhitomir	2.7	1.5	1.2
Cherkasy	2.5	2.2	0.3
Odessa	2.4	2.1	0.4
Khmelnitsky	2.4	2.0	0.4
Mykolayiv	2.3	2.7	−0.4
Ivano-Frankivsk	2.3	2.2	0.2
Crimea	2.2	2.1	0.1
Transcarpathian	2.0	0.6	1.3
Chernigiv	1.9	1.7	0.2
Rivne	1.8	0.5	1.3
Kirovograd	1.7	0.8	0.9
Kherson	1.6	1.3	0.3
Ternopil	1.6	0.8	0.7
Volyn	1.3	0.7	0.5
Chernivtsi	1.2	0.7	0.5

Table 3. *DISP* and *GC* in comparison.

	Mean	Min	Max	Correlation
GC	0.631	≈0	0.976	0.4935
DISP	0.569	0.347	0.803	

Table 4. Pre-reform and After-reform concentration ratios correlation.

	HHI_N, 1998	*HHI_N*, 1994	*C*4, 1998	*C*4, 1994
HHI_N, 1998	1.0000			
HHI_N, 1994	0.7945	1.0000		
*C*4, 1998	0.7504	0.6883	1.0000	
*C*4, 1994	0.6642	0.7539	0.8681	1.0000

Table 5. Structure of National and Region-industry samples (1998).

	National sample	Region-industry sample
Metallurgy, %	9.8	4.8
Chemicals, %	10.5	6.0
Machine building, %	39.9	38.8
Wood and paper, %	3.6	5.1
Construction materials and glass, %	11.6	10.0
Light industry, %	8.7	10.7
Foods, %	9.8	18.5
Other, %	6.2	6.0
Total, %	100.0	100.0

Table 6. Decomposition of the sample by output (1998), comparison with Russia (1992).

Branch	Ukraine 1998	Russia 1992
Energy, %	14.0	9.4
Metallurgy, %	31.0	18.7
Chemicals, %	7.0	10.7
Machine building, %	17.0	26.0
Wood and paper, %	2.0	4.4
Construction materials and glass, %	4.0	3.4
Light industry, %	2.0	9.1
Foods, %	20.0	13.3
Other, %	3.0	4.7

Data on Russia 1992 source: Brown and Brown (1999).

Table 7(*a*). Selected (44) industries' *C*4 and the number of enterprises, comparison with Russia (1992).

Code	Name	Russia 1992		Ukraine 1998	
		# of firms	*C*4	# of firms	*C*4
16152	Bricks and ceramic tiles	550	7	224	26
15271	Furniture industry	623	12	250	14
16112	Cement	49	22	17	80
19400	Printing industry	1493	23	346	35
15210	Sawmill production	468	25	68	72
14140	Mining machinery	55	30	50	49
13150	Varnish and paint	78	32	39	54
15310	Cellulose, wood pulp, paper, cartons	114	32	24	64
14620	Food and animal feed equipment	93	34	74	39

Continued from p. 28

Code	Name	Russia 1992		Ukraine 1998	
		# of firms	*C*4	# of firms	*C*4
14321	Instruments for controlling and regulating processes	91	34	42	59
11220	Oil refining	91	37	20	89
17310	Natural leather	71	38	26	77
16240	Insulation materials	42	38	11	86
15250	Veneer, plywood, all woods	35	38	12	96
14160	Railway machinery	56	39	26	89
16513	Glass packages	40	40	16	65
16272	Asphalt production	33	41	19	73
14210	Metal cutting tools	91	41	32	50
16551	China and pottery	27	43	18	59
14220	Wood processing equipment	36	44	13	92
13120	Chemical fibers	25	45	8	100
14175	Accumulator and cell industry	31	45	8	100
16232	Lime, gypsum products	45	47	16	62
13111	Nitrogen industry	22	48	7	89
13363	Rubber shoes	28	48	7	100
19770	Toy production	59	50	10	82
14195	Industrial valves	37	50	18	59
19720	Musical instruments	29	52	10	92
13130	Synthetic resins, plastic pulp	36	53	11	100
14230	Forge and pressing equipment	35	53	17	76
14325	Instruments for the measurement of mechanical quantities	33	56	13	69

Continued from p. 29

Code	Name	Russia 1992		Ukraine 1998	
		# of firms	*C*4	# of firms	*C*4
14324	Optical and optical-mechanical instruments	40	57	15	78
14350	Ball bearings	28	59	8	100
14153	Continuous transport	11	64	5	100
13351	Tires	12	67	3	100
14194	Pumps	29	68	9	95
14342	Motorcycle, bicycle production	15	70	8	100
13112	Phosphate fertilizers, inorganic chemicals	18	74	10	85
12140	Steel pipes	19	74	17	86
14111	Turbine building	25	75	6	100
14112	Boilers	35	76	8	100
14834	Metal transport containers	14	86	16	100
12150	Electro ferroalloy	6	91	3	100
18131	Perfume and cosmetics	45	93	9	91

Data on Russia 1992 source: Brown and Brown (1999).

Table 7(*b*). Selected (80) industries' *C*4 and the number of enterprises, comparison with Russia (1992); comparative statistics.

	Russia 1992		Ukraine 1998	
	# of firms	*C*4	# of firms	*C*4
Mean	139	18	52	20
Min	3	4	3	14
Max	1612	100	616	100
Correlation, *C*4	0.618			
Correlation, # of firms	0.925			

Data on Russia 1992 source: Brown and Brown (1999).

Table 8. Region-industry sample summary statistics.

	Number of observations	Mean	Standard deviation	Min	Max
PCM	1913	−0.125	3.688	−112.290	0.965
PS	1914	−0.178	1.394	−45.600	5.358
PC	1911	−0.112	1.290	−43.653	5.297
HHI_R	1919	0.702	0.312	0.028	1.000
l*HHI_R*	1924	0.733	0.306	0.031	1.000
HHI_M	1919	0.452	0.213	0.016	1.000
l*HHI_M*	1924	0.498	0.221	0.032	1.000
KL	1918	46.062	71.646	0.105	2460.069
EX	1924	0.193	1.995	0.000	92.361
IM	1924	0.325	0.289	0.000	0.992

Table 9. Nationwide sample summary statistics.

	Number of observations	Mean	Standard Deviation	Min	Max
PCM	289	0.063	0.795	−9.274	0.943
PS	289	−0.534	6.986	−118.158	0.704
PC	289	−0.330	3.587	−43.653	2.989
HHI_N	289	0.378	0.306	0.006	1.000
l*HHI_N*	271	0.397	0.317	0.008	1.000
*C*4	289	0.783	0.247	0.067	1.000
l*C*4	271	0.794	0.239	0.097	1.000
KL	289	59.833	62.698	4.657	704.194
EX	289	0.213	0.357	0.000	4.188
IM	289	0.405	0.323	0.000	0.996
DISP	289	0.569	0.069	0.348	0.804
l*DISP*	271	0.576	0.070	0.365	0.876
*HHI_N***DISP*	289	0.208	0.162	0.005	0.587
l*HHI_N**l*DISP*	271	0.220	0.172	0.005	0.664
*C*4**DISP*	289	0.440	0.137	0.054	0.644
l*C*4*l*DISP*	271	0.447	0.137	0.065	0.710

Table 10. Key variables' correlation.

	PCM	*PS*	*PC*	*KL*	*EX*	*IM*	*HHI_N*	*C*4	*DISP*
PCM	1.00								
PS	0.20	1.00							
PC	0.08	0.71	1.00						
KL	−0.11	−0.03	0.01	1.00					
EX	−0.45	0.03	0.03	0.00	1.00				
IM	−0.19	0.02	−0.06	0.10	0.02	1.00			
HHI_N	−0.28	−0.15	−0.19	0.18	0.18	0.26	1.00		
*C*4	−0.15	−0.07	−0.08	0.19	0.13	0.28	0.75	1.00	
DISP	0.10	0.06	0.08	−0.04	−0.16	−0.15	−0.36	−0.34	1.00

Table 11. Profitability measures testing, *OLS*.

	PCM		*PS*		*PE*	
HHI_N	−0.442***	(−2.786)	−3.304**	(−2.120)	−2.416***	(−3.006)
DISP	−0.620	(−0.955)	0.351	(0.055)	0.081	(0.025)
IM	−0.347**	(−2.517)	0.772	(0.569)	−0.450	(−0.644)
EX	−0.956***	(−7.987)	0.731	(0.622)	0.348	(0.574)
KL	−0.001	(−1.076)	0.012	(1.546)	0.005	(1.401)
*D*1	−0.086	(−0.318)	−9.406***	(−3.544)	−3.035	(−2.218)
*D*2	−0.083	(−0.375)	−0.378	(−0.174)	0.166	(0.148)
*D*3	0.183	(0.843)	−0.393	(−0.184)	0.105	(0.096)
*D*4	−0.051	(−0.278)	0.002	(0.001)	0.056	(0.060)
*D*5	0.080	(0.284)	−0.183	(−0.066)	−0.115	(−0.081)
*D*6	0.038	(0.180)	0.344	(0.168)	0.122	(0.115)
*D*7	0.130	(0.584)	0.034	(0.016)	−0.035	(−0.031)
*D*8	0.102	(0.474)	−0.019	(−0.009)	−1.654	(−1.512)
CONS	0.962**	(2.181)	−0.189	(−0.044)	0.555	(0.248)
R^2	0.276		0.095		0.087	

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 12(*a*). *OLS* Estimation of Nationwide model; *C*4 as concentration.

PCM	Original specification		Specification with interaction	
*C*4**DISP*			1.844	(0.807)
*C*4	−0.040	(−0.205)	−1.120	(−0.828)
DISP	−0.071	(−0.109)	−1.249	(−0.780)
IM	−0.439***	(−3.150)	−0.438***	(−3.141)
EX	−0.990***	(−8.196)	−0.979***	(−8.059)
KL	−0.001	(−1.042)	−0.001	(−1.048)
*D*1	−0.157	(−0.575)	−0.148	(−0.541)
*D*2	−0.152	(−0.679)	−0.159	(−0.710)
*D*3	0.126	(0.573)	0.122	(0.557)
*D*4	−0.023	(−0.124)	−0.039	(−0.210)
*D*5	0.170	(0.602)	0.151	(0.532)
*D*6	0.019	(0.089)	0.013	(0.061)
*D*7	0.152	(0.675)	0.145	(0.641)
*D*8	0.140	(0.636)	0.135	(0.613)
CONS	0.556	(1.145)	1.267	(1.260)
Adjusted R^2	0.221		0.258	

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 12(*b*). IV Estimation of Nationwide model; *C*4 as concentration.

PCM	Original specification		Specification with interaction	
*C*4**DISP*			0.621	(0.078)
*C*4	−0.074	(−0.409)	−0.435	(−0.094)
DISP	−0.182	(−0.357)	−0.576	(−0.113)
IM	−0.349***	(−3.180)	−0.349***	(−3.184)
EX	−1.131***	(−12.148)	−1.128***	(−10.771)
KL	0.001**	(2.032)	0.001**	(2.020)
*D*1	−0.410*	(−1.922)	−0.405*	(−1.817)

Continued from p. 33

PCM	Original specification		Specification with interaction	
*D*2	0.085	(0.481)	0.084	(0.473)
*D*3	0.158	(0.922)	0.158	(0.922)
*D*4	0.011	(0.077)	0.007	(0.046)
*D*5	0.218	(1.015)	0.214	(0.951)
*D*6	0.013	(0.082)	0.013	(0.077)
*D*7	0.220	(1.279)	0.219	(1.267)
*D*8	0.170	(1.005)	0.170	(1.006)
CONS	0.511	(1.315)	0.746	(0.243)
Adjusted R^2	0.380		0.379	
Hausman test: *OLS* is inconsistent	$\chi^2(11) = 71.06$	p = 0.000	$\chi^2(11) = 70.56$	p = 0.000
F-test of significance of IVs in the 1-stage regression	F(13,257) =		F(14,256) =	
*C*4	= 66.87	p= 0.000	= 72.24	p = 0.000
*C*4**DISP*			= 59.45	p = 0.000

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 13(*a*). *OLS* Estimation of Nationwide model; *HHI_N* as concentration.

PCM	Original specification		Specification with interaction	
*HHI_N*DISP*			3.437	(1.118)
HHI_N	−0.442***	(−2.786)	−2.303	(−1.377)
DISP	−0.620	(−0.955)	−1.275	(−1.459)
IM	−0.347**	(−2.517)	−0.362***	(−2.613)
EX	−0.956***	(−7.987)	−0.940***	(−7.802)
KL	−0.001	(−1.076)	−0.001	(−1.118)
*D*1	−0.086	(−0.318)	−0.097	(−0.358)
*D*2	−0.083	(−0.375)	−0.112	(−0.504)

Continued from p. 34

PCM	Original specification		Specification with interaction	
*D*3	0.183	(0.843)	0.169	(0.777)
*D*4	−0.051	(−0.278)	−0.079	(−0.430)
*D*5	0.080	(0.284)	0.052	(0.186)
*D*6	0.038	(0.180)	0.014	(0.067)
*D*7	0.130	(0.584)	0.100	(0.446)
*D*8	0.102	(0.474)	0.086	(0.397)
CONS	0.962**	(2.181)	1.352**	(2.405)
Adjusted R^2	0.242		0.243	

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 13(*b*). IV Estimation of Nationwide model; *HHI_N* as concentration.

PCM	Original specification		Specification with interaction	
*HHI_N***DISP*			0.277	(0.031)
HHI_N	−0.144	(−0.858)	−0.294	(−0.061)
DISP	−0.287	(−0.557)	−0.341	(−0.188)
IM	−0.334***	(−3.061)	−0.335***	(−2.970)
EX	−1.121***	(−11.991)	−1.119***	(−10.653)
KL	0.001**	(2.002)	0.001**	(1.984)
*D*1	−0.393*	(−1.845)	−0.393*	(−1.844)
*D*2	0.097	(0.546)	0.095	(0.516)
*D*3	0.170	(0.996)	0.169	(0.985)
*D*4	0.000	(0.001)	−0.002	(−0.012)
*D*5	0.197	(0.913)	0.195	(0.860)
*D*6	0.013	(0.078)	0.011	(0.067)
*D*7	0.212	(1.242)	0.210	(1.139)
*D*8	0.167	(1.003)	0.166	(0.973)
CONS	0.563	(1.587)	0.594	(0.543)
Adjusted R^2	0.390		0.388	

Continued from p. 35

PCM	Original specification		Specification with interaction	
Hausman test: *OLS* is inconsistent	$\chi^2(11) = 71.97$	p = 0.000	$\chi^2(11) = 70.79$	p = 0.000
F-test of significance of IVs in the 1-stage regression	F(13,257) =		F(14,256) =	
HHI_N	= 42.36	p = 0.000	= 42.32	p = 0.000
*HHI_N*DISP*			= 40.34	p = 0.000

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 14(*a*). *OLS* Region-industry model estimation.

PCM	Original specification		Specification with mixed concentration	
HHI_R	−0.574**	(−2.006)		
HHI_M			−0.545	(−1.347)
IM	−0.457	(−1.402)	−0.547*	(−1.701)
EX	−0.132***	(−3.564)	−0.132***	(−3.558)
KL	−0.001	(−0.550)	−0.001	(−0.640)
*D*1	0.099	(0.127)	0.075	(0.096)
*D*2	−0.943*	(−1.802)	−0.985*	(−1.882)
*D*3	0.092	(0.185)	0.074	(0.150)
*D*4	−0.142	(−0.383)	−0.183	(−0.494)
*D*5	−0.071	(−0.138)	−0.043	(−0.084)
*D*6	−0.233	(−0.534)	−0.252	(−0.577)
*D*7	−0.909**	(−2.093)	−0.897**	(−2.059)
*D*8	0.007	(0.019)	0.047	(0.117)
CONS	0.702	(1.771)	0.592	(1.497)
Adjusted R^2	0.021		0.020	

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

Table 14(*b*). IV Region-industry model estimation.

PCM	Original specification		Specification with mixed concentration	
HHI_R	−0.343	(−0.870)		
HHI_M			−0.4414	(−0.732)
IM	−0.501	(−1.518)	−0.5508*	(−1.710)
EX	−0.133***	(−3.576)	−0.1326***	(−3.563)
KL	−0.001	(−0.592)	−0.0008	(−0.643)
*D*1	0.096	(0.124)	0.07796	(0.100)
*D*2	−0.991	(−1.883)	−0.9992*	(−1.896)
*D*3	0.053	(0.106)	0.05934	(0.119)
*D*4	−0.170	(−0.457)	−0.1887	(−0.508)
*D*5	−0.062	(−0.121)	−0.0438	(−0.086)
*D*6	−0.238	(−0.545)	−0.2511	(−0.574)
*D*7	−0.922**	(−2.123)	−0.9054**	(−2.072)
*D*8	0.017	(0.041)	0.04359	(0.109)
CONS	0.572	(1.347)	0.55193	(1.277)
Adjusted R^2	0.021		0.020	
Hausman test: *OLS* is inconsistent	$\chi^2(1) = 0.73$	p = 0.393	$\chi^2(1) = 0.05$	p = 0.817
F-test of significance of IVs in the 1-stage regression	F(11,1900) =		F(11,1900) =	
HHI_R	=240.22	p = 0.000		
HHI_M			= 156.16	p = 0.000

t-statistics are in parentheses; * — significant at 10%, ** — significant at 5%, *** — significant at 1%.

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